An Unconventional Approach to Overcome the Extreme Angulation of LAD: A Challenging Percutaneous Coronary Intervention

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ABSTRACT

We herein describe a challenging acute anterior ST-elevation myocardial infarction (STEMI) case. The patient was hemodynamically unstable during the procedure and the extremely angulated culprit vessel hindered our repeated attempts of wiring. Procedural complexity and risks were increased not only due to angulation but also the bifurcational nature of the culprit lesion. We report an innovative solution that enabled the successful revascularisation of such a complex situation, after the failure of multiple attempts of conventional methods for wiring. We also briefly review the literature about recommended methods for such severely angulated vessels.

Key Words: *Angulation, infarction, Vessel, Angiography.*

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INTRODUCTION

Severely angulated coronary lesions represent one of the most challenging aspects of the percutaneous coronary intervention (PCI); both in terms of procedural failure and complications.[1]

While several methods and equipments for such lesions have been developed,[1-3] they may not be readily available in emergency situations. Also, one should always keep in mind that the failure risk of these methods is always a possibility.

We describe a case of left main coronary artery (LMCA) bifurcation stenting with a rather unfavourable left anterior descending (LAD) angulation, in the setting of acute anterior ST- elevation myocardial infarction (STEMI), further complicated by cardiogenic shock. Here, we review our practically planned strategy for this challenging case, where adequate equipment was lacking and conventional methods were not successful.

CASE REPORT

A 65-year, hypertensive and smoker, male patient was admitted to the emergency department with crushing chest pain for two hours. Electrocardiography revealed acute anterior STEMI. He was admitted to the catheterisation laboratory for emergency PCI. Coronary angiography was performed *via* the left radial route.

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The right coronary artery (RCA) was totally occluded from the ostial level. LMCA had 50-60% occlusion. There was 80% occlusion in the proximal left circumflex artery (LCx) and 90% occlusion with thrombus formation and ulceration after the first obtuse marginal artery (OM1). Proximal LAD was totally occluded (Figure 1A). RCA lesion was considered as a chronic total occlusion, so revascularisation was not planned in this acute setting.

Two different hydrophilic guidewires (PT light support and Pilot 50) were chosen for the procedure. LCx and intermediate artery (IMA) were wired consecutively. However, LAD could not be wired despite repeated attempts by two different experienced interventional cardiologists, due to severe vessel angulation (Figure 1B). The distal tip of the guidewire was bent at different angles, yet none of the attempts was successful. FineDuo double lumen microcatheter (TERUMO) was utilised, but still, guidewire could not be passed through LAD. Upon failure of these approaches, the reverse wiring technique was performed, yet LAD could not be wired. As a radical decision, a drug-eluting stent (DES) (4.0×30 mm) was deployed in LMCA (Figure 1C) extending into proximal LCx in order to alter the anatomy and modify the extreme LAD angulation. After the deployment of the stent, OM1 ostium was occluded. However, the angulation of LAD was altered enough to wire the vessel through the stent struts and cross the total occlusion (Figure 2A). After dilation of stent struts with PTCA balloon, proximal LAD was dilated and a 2.75×22 mm DES was deployed at the lesion site. OM1 was wired through stent struts and dilated with PTCA balloon. Thrombolysis in myocardial infarction (TIMI) 3 flow was achieved successfully in both LAD and OM1.

The patient had high thrombus burden and was exposed to high amounts of contrast agent (400 ml), so he was admitted to the coronary intensive care unit (ICU) and tirofiban infusion was started.

Figure 1A: Left coronary system.

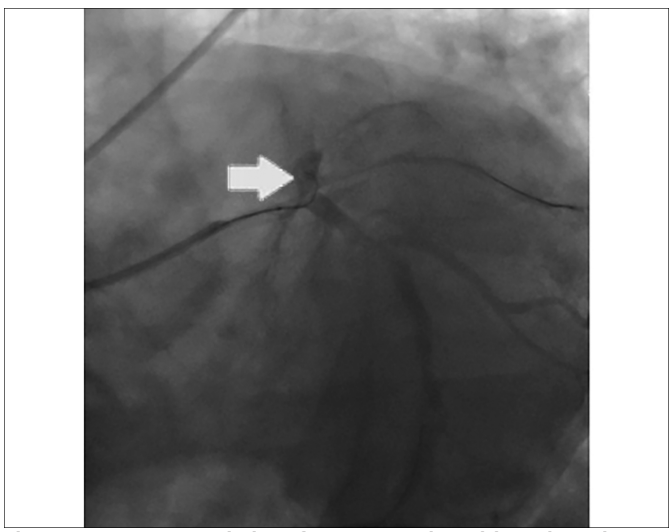

Figure 1B: Severe angulation of LAD preventing wiring. The red arrow shows severe angulation.

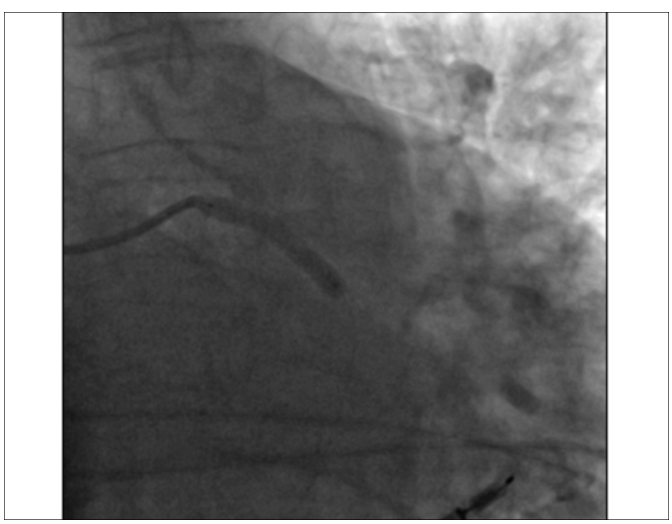

Figure 1C: Stent deployed in LMCA extending into LCx to modify LAD angulation.

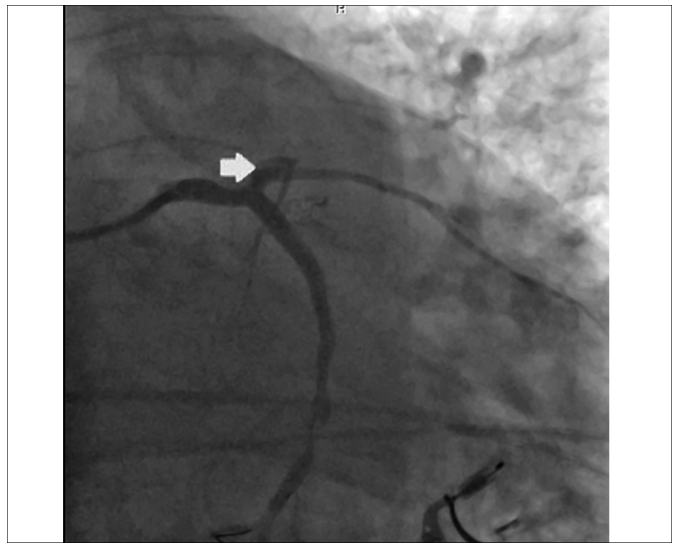

Figure 2A: LAD angulation after stent deployment in LCx. The red arrow shows modified LAD angulation.

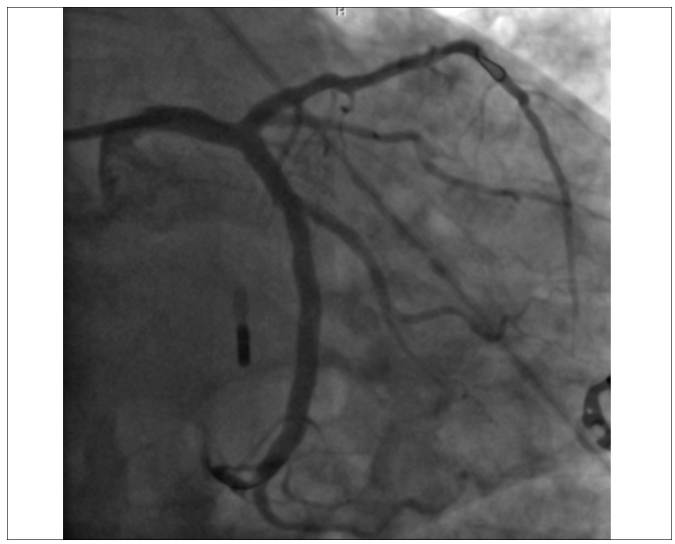

Figure 2B: Left coronary system after complete revascularisation

The patient became hemodynamically unstable at the ICU, so a second stage PCI was planned. He was admitted to the catheterisation laboratory for second-stage PCI and an intra-aortic balloon pump was inserted before the procedure.

First, LCx and OM1 were wired and a 4.0×30 mm DES was deployed in distal LCx. After distal LCx lesion was stented, proximal OM1 was dilated with PTCA balloon and a 3.5 mm non-compliant (NC) balloon was advanced into LCx. A 2.5×15 mm DES was deployed in OM1 by the T and small protrusion (TAP) technique, and final kissing balloon inflation was performed. Following the first bifurcation stenting, LAD was wired through stent struts and over the LCx wire a 4.0 mm NC balloon was advanced into LMCA. A 3.0×12 mm DES was deployed in LAD ostium by TAP technique and final kissing balloon inflation was performed. Following the second bifurcation stenting, the final proximal optimisation technique (POT) was done by 4.5 mm NC balloon. Complete revascularisation in both LAD and LCx was achieved successfully (Figure 2B).

The patient was discharged uneventfully one week after the procedure.

DISCUSSION

Bifurcation lesions combined with angulated vessels in the setting of myocardial infarction can lead to extremely complicated PCIs. Appropriate equipment and experience are mandatory in coping with such challenging cases. However, equipment may not be readily available in the catheterisation laboratories or conventional methods may not be successful. Therefore, alternative approaches, as described in this case, may be needed. Also, this case demonstrated that lesions that look uncomplicated at first glance can be deceivingly angulated and very hard to wire.

Choosing hydrophilic or stiff guidewires with a wide curve in the distal tip, or utilisation of microcatheters are the first-line methods regarding the angulated bifurcation lesions.[3-5] The reverse wiring technique, steerable microcatheters such as the Venture wire control catheter (St. Jude Medical), angulated microcatheters such as supercross microcatheter (Teleflex) and debulking strategies may also be used in the case of failure with the first-line approach.[1-4,6]

In this case, using two distinct hydrophilic guidewires (PT light support and Pilot 50) bent with wide curves and utilisation of a FineDuo double microcatheter (TERUMO) were not successful, so we decided to use the reverse wiring technique. Currently used modified reverse wiring technique can be summarized as reverse bending a guidewire 3 cm from the distal tip, advancing it by a dual lumen microcatheter through the main vessel, then retracting the microcatheter and manipulating the guidewire to pass through the side vessel. This technique has been proposed as an effective and safe alternative method to be used in angulated bifurcation lesions.2,3 However, in our case, reverse wiring was also not successful. We believe that the very proximal location of the total occlusion in LAD may have prevented this trick from working.

Deploying an undersised balloon in proximal LCx and forcing the guidewire into LAD could have been a useful technique but we could not take the risk of cutting the LCx flow off for a prolonged time, as the patient was already hemodynamically unstable and LCx was the only functional major vessel of the patient.

Other strategies that have been reported to be successful in the literature include, debulking strategies utilising rotablation or excimer laser coronary angioplasty (ELCA)[4] and steerable microcatheters such as venture wire control catheter (St. Jude Medical).[6]

Apart from the failure of first-line methods, the lack of dedicated equipment was another factor that forced us to do the emergency LMCA stenting for LAD access. Particularly, venture wire control catheter would have been very useful as its flexible design allows the operator to adjust the distal tip curve accordingly to the vessel angulation.[4,6]

Extreme angulation of LAD was the main obstacle that prevented us from the wiring. Despite numerous attempts and utilisation of special equipment, we were not successful; only modification of the vessel anatomy allowed us to proceed with the operation. We believe that when the stent was deployed in LMCA extending into LCx, it reshaped distal LMCA anatomy and altered the plaque composition resulting in reduced LAD angulation, thus allowing us to wire LAD successfully.

On encountering severely angulated bifurcation lesions, stenting of the main vessel may help to alter the anatomy of the vessel to perform easier wiring.

PATIENT'S CONSENT:
A written informed consent was obtained from the patient.

COMPETING INTEREST:
The authors declared no competing interest.

AUTHORS' CONTRIBUTION:
KE: Conception and design of the work and supervision of the work.
KA: Planning of the methodology and writing.
NO: Data collection, analysis of data, and literature review.
YA: Critical revision and final approval of the version to be published.
All the authors have approved the final version of the manuscript to be published.

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